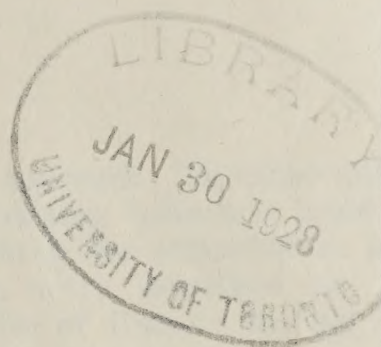


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CANADA



THE
HISTORY AND PRESENT
STATUS OF WHEAT PRODUCTION
IN CANADA

Together with
A REVIEW OF THE PART PLAYED BY THE [PLANT
BREEDER IN INTRODUCING SUPERIOR
VARIETIES

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DOMINION OF CANADA
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THE EXPERIMENTAL FARMS BRANCH
E. S. ARCHIBALD, B.A., B.S.A., Director

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FOREWORD

Among the field crops of Canada wheat stands supreme. No other natural product has been able to compare with it as a vitalizing influence upon the economic life of the Dominion as a whole and nothing has attracted so much attention from the outside world. Wheat has been aptly described as "the economic fairy to the industrial and commercial life of Canada having built practically the whole economic structure of the Prairie Provinces."

The opening up to civilized settlement of the vast area comprised by these provinces is a story of alluring adventure and of glorious achievement.

The first people to be attracted to this territory were certain English adventurers who organized themselves into a company to prosecute the fur trade and who ultimately became the great Hudson Bay Company under a charter granted in 1670 by Charles II of England. This charter made "The Governor and Company of adventurers trading with Hudson Bay" rulers of half a continent.

It is interesting to Canadians to note that it was in 1867, the year which marked a new epoch in the political life of the young Dominion, that the rights of this huge trading concern were purchased by Canada.

Up to the latter date agricultural development within this territory had hardly begun. It was confined chiefly to the activities of that little band of hardy pioneers known as the Selkirk Settlers, which had been brought from Scotland by Lord Selkirk to colonize a tract of some 116,000 acres of land granted by the Hudson Bay Company in 1811 and situated on the banks of the Red river near what is now Winnipeg.

EARLY HISTORY OF WHEAT GROWING

The first successful harvest of spring wheat in the Prairie Provinces was harvested in 1815 by the settlers of Selkirk following two disastrous and discouraging years. Up to 1831 the colonists, we are told, did not produce more than their own requirements but during the year the Governor of the Hudson Bay Company offered to handle any surplus they might have. This stimulated interest in wheat growing as a business but unfortunately when the needs of the company were supplied the prices fell to a point which rendered further development unattractive. Added to this there developed certain complaints against the poor quality of the flour furnished by the growers due to improper methods of milling and handling. This resulted in the company deciding to buy the whole wheat and mill it themselves under supervision. For this purpose windmills were used at first rather extensively although before long these gave way to more advanced methods.

The first real impetus to wheat growing in Western Canada was received about 1870 when the first "purifier" for separating bran and middlings from flour was introduced from the United States.

DEVELOPMENT OF THE INDUSTRY

About 1876 "wheat-trading" as a definite business enterprise became firmly established. In that year the crop report issued by the Government, and which incidentally was the first Government report to be issued up to that time, placed the wheat acreage at 480,000 acres. To-day, just fifty years later, the acreage

devoted to wheat production, according to the Dominion Bureau of Statistics, has passed the twenty-one million mark. Similarly the grain trade has come to assume gigantic proportions and is now one of the largest businesses in Canada. As a wheat producer Canada now ranks with India and surpasses all other countries except the United States.

The enormous strides made by Canada in wheat production, have taken place chiefly during the past twenty-five years. Thus in 1900, the area devoted to wheat raising in the Prairie Provinces is recorded as only about two million acres, while by 1925 this area had increased almost tenfold as already indicated.

EXPORTS OF CANADIAN WHEAT AND FLOUR

As an exporter of wheat and wheat products Canada now leads the world, having a greater surplus for export than any other country. It is interesting to note in this connection that this country actually exports as much as British India, Australia and Argentina combined.

During the five-year period 1921-25, her average annual exports of wheat and flour amounted to approximately two hundred and fifty million bushels and 9,870,000 barrels respectively, or about 33.5 per cent of all the wheat and flour concerned in world trade.

An analysis of trade returns during the past two decades indicates that the flour-milling industry of Canada has kept well abreast of the development which has taken place in wheat production. Indeed, during the past four years particularly, the production of flour in Canada has steadily increased, with the result that by 1926, our exports of flour reached the twelve million barrel mark, or approximately 30 per cent above the average of the previous five-year period.

Owing to the high quality of Canadian wheat and wheat flour these products are in demand in many lands. Thus our wheat is now sold direct to over fourteen different countries while trade returns show that our wheat flour finds its way to the markets of over fifty countries.

In the United Kingdom, which is our best customer, the hard red wheat of Canada is valued chiefly for mixing with the softer and "weaker" wheats produced at home. Thus Old Country millers find that their home-grown wheat when mixed with a substantial proportion of Canadian hard wheat produces flour of greater "strength" and "stability" than when used alone.

The relatively small amount of wheat produced in Ontario, Quebec, and the Maritime Provinces is marketed locally or at local milling centres and figures scarcely at all in export trade.

While certain other Canadian products which enter into international trade play an exceedingly important part yet, in the last analysis, it is upon wheat and wheat products that the commercial structure of Canada very largely rests at the present time.

THE INTRODUCTION OF SUPERIOR VARIETIES

The rise to prominence of Canada, as a wheat-growing country, has been made possible in no small degree by the work of the plant-breeder. It is probably safe to say that in few countries, if any, has the work of the scientific breeder of plants contributed more directly and substantially to national prosperity than it has in Canada. He has given to Canada varieties of wheat which have added millions of dollars annually to the value of Canadian production and has turned what was once a distinctly hazardous occupation throughout vast areas of Western Canada into a relatively safe and profitable enterprise. The varieties which have proven of greatest value to Canada thus far are described in detail in the following pages.

RED FIFE

The first notable variety to be introduced into Western Canada was one which had been developed more or less fortuitously, by a farmer named David Fife of Peterborough county, Ontario, after which gentleman the wheat came to be named. The very interesting history of the origin and development of this wheat has been published so frequently that it will not be discussed here. This variety, fortunately for Canada, proved to be a wheat of very high milling and baking quality as well as a good yielder. From the year of its introduction into Western Canada (about 1882) until the appearance of the world-famous *Marquis*, some twenty-six years later, Red Fife was the leading, and in fact the standard spring wheat variety of Western as well as of Eastern Canada. It was this variety which came to be taken as the basis upon which Canadian official and commercial grades of wheat were established. Thus the original grades required that, in each case, there must be a certain minimum per cent of Red Fife present. It is of further interest to note that practically all of our leading spring wheat varieties in Canada to-day are more or less closely related to Red Fife.

While the introduction of the Red Fife variety into Western Canada constituted an epoch-making event, yet this variety possessed certain serious defects. In the first place it became apparent, after several more or less disastrous experiences, that Red Fife matured too late to be depended upon, year in and year out, to escape early summer and fall frosts, in certain districts. The variety also proved to be very susceptible to stinking smut and inclined to lack strength of straw, particularly on the summer-fallows of Manitoba.

When the Dominion Experimental Farm System became established (in 1886) the defects of Red Fife, especially its tardiness in maturing, were quickly recognized by the astute and far-seeing Dr. Wm. Saunders, who became the first Director of the Experimental System. Dr. Saunders realized that if those great virgin plains of the West, just then opening up to extensive exploitation, were ever to attain a position of prominence as a wheat producing country, an earlier maturing variety than Red Fife must be employed. The story of how he set about to secure for Canada more suitable varieties of wheat as well as of other crops is one of compelling interest.

INVESTIGATIONS OF NEW INTRODUCTIONS

The first step in connection with the above undertaking obviously was to determine the adaptability for Canadian conditions of the many different varieties of spring wheat grown in different parts of the world. Extensive collections accordingly were made from numerous sources and subjected to critical tests at the Central Experimental Farm near Ottawa, Ont., as well as at the Branch Farms throughout Canada. Among these varieties were found some possessing the ability to ripen earlier than Red Fife, but in all cases these varieties were found to possess defects which precluded them from general cultivation. The most notable variety was one called Ladoga, named after the region of Lake Ladoga, Northern Russia from which it came. This variety proved to be about a week earlier in ripening than Red Fife and was also fairly productive, but it was deficient in baking quality.

PRESTON AND STANLEY

Failing to locate the desired variety from among importations, Director Saunders decided to resort to artificial crossing with the hope that he might succeed in *producing* a new variety which would combine in high degree, the major qualities sought. For this work he first chose as parents the varieties Ladoga and Red Fife. His objective in this case was to produce a variety

combining the early ripening ability of the former with the good quality of the latter. In this he only partially succeeded. Of the numerous "combinations" resulting from this cross two were considered sufficiently promising to receive names. These were given the names Preston and Stanley. Both were earlier than Red Fife but neither was as good in baking quality, although superior to Ladoga. They undoubtedly marked an advance in breeding work although, in themselves, not good enough to receive the commendation of the milling trade. Preston, however, had become fairly widely distributed, especially in the northern wheat growing districts of Manitoba and Saskatchewan by the time Marquis, about which we shall speak presently, appeared on the scene.

HURON AND PERCY

Crossings between Ladoga and White Fife, a white-kernelled variety similar in all other respects to Red Fife yielded a number of forms two of which received the names Huron and Percy. The former is now considered the most promising variety for most parts of Eastern Canada wherever people are not too particular about the matter of bread-making qualities. It yields well in Western Canada also but on account of its quality it is not recommended for cultivation there.

EARLY RIGA

Another interesting variety bearing the name Early Riga resulted from this early crossing work. This came from a cross made in 1891 between two imported varieties. One of these called Gehun came from the Himalayan mountains of East India, from an elevation of about 11,000 feet. The other called Onega was brought from near Archangel, Northern Russia. Early Riga proved to be one of the earliest ripening wheats grown. It possessed very fair baking quality but was less productive than Red Fife. The latter fact seems to have discouraged its cultivation as we scarcely ever hear of it in the country. It has proven valuable in further breeding work however, constituting as it does one of the parents of Garnet about which variety we shall speak later.

In the search for an earlier maturing variety than Red Fife the hope was entertained that this might be developed from early maturing plants discovered within some of the varieties then under observation and study. This hope was partially fulfilled in the discovery of such plants within Red Fife. After several years trial the most promising of these new "lines" was given the name Early Red Fife. This variety undoubtedly is earlier than Red Fife and in certain sections, especially in Saskatchewan and Alberta, is now grown to a considerable extent. It has proven to be very susceptible to wheat stem rust, however, for which reason its cultivation in districts where this disease is liable to be serious should be avoided.

MARQUIS

This variety originated from a cross made in 1892 under the direction of Dr. Wm. Saunders, between an early maturing variety obtained in India under the name of Hard Red Calcutta, and the leading Canadian wheat, Red Fife. The progeny of this cross was still quite composite in character at the time (1903) Dr. Chas. Saunders became Dominion Cerealists and began the systematic analysis of all promising material which came into his hands. Many individual plants were selected out of the mixture above referred to and their succeeding progeny subjected to critical study in "separate cultures" for some years. The so-called "chewing test" then in vogue, revealed distinct differences in gluten "strength" between some of these lines and appreciably assisted in the final isolation of a number of superior lines which appeared quite similar in all essential particulars. These were bulked and further tested, finally receiving the name Marquis.

The chief points which distinguish Marquis are its ability to mature from six to ten days earlier than Red Fife; greater strength of straw than the latter variety; non-shattering habits as contrasted with the easy shattering tendency of Red Fife; its greater resistance to stem rust; and its greater productiveness. It is probably safe to say that no new cereal variety thus far introduced anywhere has excelled in so many points or has taken the place of other varieties over so wide an area. Its introduction into Canadian agriculture completely overshadows in importance any other single event, marking as it undoubtedly does a new epoch in the agricultural and industrial life of the Dominion. By 1915 only six or seven years after its introduction, Marquis had taken the lead over all other varieties throughout the wheat-growing areas of the western provinces, which lead it increased so rapidly that within ten or twelve years from its first introduction it is credited with having occupied not less than 90 per cent of all the spring wheat area in the Dominion. Even in the United States Marquis is conceded to be the most generally grown spring wheat variety, occupying in that country between 60 and 70 per cent of the entire spring wheat area.

It is now possible to calculate fairly accurately the extent to which Marquis has been able to increase the money value of our annual wheat crop over that which would have been possible had we still to depend upon Red Fife as our leading variety. Thanks to our system of Experimental Farms and Stations we now have the results of several years comparative yielding tests which demonstrate very definitely the superior yielding ability of the Marquis variety at practically all points where the tests have been made. According to these tests, it would appear safe to say that Marquis excels Red Fife in yielding power by at least 5 bushels per acre over the West generally. Assuming that Marquis now occupies 15,000,000 acres, or approximately 75 per cent of the area devoted to wheat in Canada and that this area yields 5 bushels more than Red Fife would have yielded (had it been possible to grow Red Fife on the same land) we find that our harvests have been increased by 75,000,000 bushels annually. In other words we are able to realize probably \$100,000,000 more from our wheat crop annually than would have been possible had we still to rely upon the variety with which we started. Even if the increased yield which Marquis gave over Red Fife were reduced by one-half we still have an enormous sum to place to the credit of the former variety each year.

It must also be remembered that the advent of Marquis has made it possible to grow a high yielding, high quality wheat in many districts in which wheat might not have been attempted, or if attempted would have yielded much less, and, in many cases would have been of lower quality and grade. While, as may naturally be expected, Marquis may have to give way in certain districts to other varieties which prove better adapted to meet the conditions which prevail there, yet at the present time Marquis reigns supreme as a "general" variety. It is also interesting to note that practically all varieties of common spring wheat which contend for a place in Western Canada are more or less closely related to Marquis, from which they have inherited some of their major virtues.

PRELUDE

While Marquis proved an exceedingly valuable variety and one which was able to adapt itself over an enormous area, yet the need for a still earlier maturing variety has been urgently felt in a great many districts. Although the quest for early maturing varieties has been going on ever since the Experimental Farms were first established, yet practically all of the extra early sorts tested prior to 1912 possessed certain more or less serious defects and were not recommended for general cultivation. During the winter of 1912-13, however, a distribution was made to western farmers of an extra early variety which had

received the name Prelude and which promised at the time to be a most satisfactory one to grow in those districts in which extra early sorts are imperative.

Prelude ripens about two weeks ahead of Marquis, produces a large, red kernel of high baking quality and a short and rather fine straw. The latter is a distinct advantage in districts which tend to encourage the production of straw of too great length although a disadvantage under certain other conditions.

Unfortunately Prelude has not proven to be very productive, with the result that it now occupies a relatively insignificant place and is found only in a few scattered districts where early frosts have made the growing of such varieties as Marquis a precarious undertaking.

Prelude was developed as a result of several crossings the first of which was made in 1888 between Ladoga and White Fife. One of the combinations selected from the progeny of this cross was given the name Alpha. It will be noted in passing that Alpha is a sister variety of Huron and Percy.

Alpha was crossed in 1892 with Hard Red Calcutta, one of the parents of Marquis. One of the combinations resulting from this cross was given the name Fraser. In 1903 Fraser was crossed with Gehun, one of the parents of Early Riga. To one of the lines resulting from this Fraser-Gehun cross the name Prelude was given.

While Prelude has not taken a very important place among the varieties in common use, yet it has been used to excellent advantage in breeding work as illustrated later in connection with the development of Reward.

RUBY

This early maturing variety originated from a cross made by the Cereal Division, Ottawa, in 1905 between Red Fife and Downy Riga. The latter was a selection from the more or less composite variety Early Riga. This makes Ruby and Garnet fairly closely related.

Ruby matures from five to ten or twelve days earlier than Marquis and therefore a few days later than Prelude. Under certain conditions this difference may either be accentuated or reduced depending upon what the conditions are. The straw of Ruby is longer than that of Prelude and therefore better suited to those conditions which tend to produce a meagre straw. In milling and baking qualities Ruby ranks with Marquis.

Ruby was introduced during the years of the Great War (about 1915) at which time it was hoped that it might aid in increasing the amount of wheat for the allied armies. While it has served a very useful purpose and has become fairly widely distributed, especially in districts which are always glad to welcome a variety which is ready to harvest early, yet it has been rather disappointing as regards yield. Many growers who adopted Ruby enthusiastically at first have found that it not only yields considerably less than such later varieties as Marquis, but that it shatters readily when ripe. Added to this is the recognized tendency of the straw to be weak under comparatively little provocation. The result has been that many farmers would rather run the risk of maturing a satisfactory crop of Marquis than sow a variety which they know cannot give them the returns they would like.

GARNET

This variety matures with Ruby but appears to be considerably more productive and a little stronger in the straw. It also shatters less than either Ruby or the Fifes. At this date it would appear reasonably certain that Garnet will occupy an important place especially in those districts which favour an early ripening variety. It was placed on the market in the spring of 1926 for the first

time when over 3,000 farmers obtained from two to four bushels each from the Dominion Experimental Farms. A considerable number secured larger quantities from certain private growers who had multiplied test samples which they had secured some years previous. It is estimated that approximately 300,000 bushels of Garnet seed was sown in Western Canada in the spring of 1927. Within another year or two therefore the status of this variety should be pretty well established and the extent to which it is able to contribute to the success of Canada as a great wheat-growing country should be determined. Up to the present time probably no new variety has been so thoroughly and widely tested both for field performance and for milling and baking qualities. Since the results of these tests are given in detail in a recent bulletin they will not be discussed here.*

Garnet, like Prelude, is the product of several crosses the first of which dates back to 1888 when Preston, one of its parents, was brought into existence. This variety, as already pointed out, originated from a cross between Ladoga and Red Fife. Early Riga, the other parent of Garnet, came from a crossing between Onega and Gehun, as already explained (see page 6).

REWARD

This variety is not yet in general circulation but in view of the publicity it has been receiving it would appear desirable to include at least a brief reference to it in this bulletin. It was developed from a cross between Marquis and Prelude made in 1912 at Ottawa, with the hope of producing a variety which would combine the very early ripening habit of Prelude with the greater productiveness and better straw of Marquis. This cross resulted in several exceedingly interesting and promising combinations one of which received the name Reward. Unfortunately this variety is not altogether uniform in type. Furthermore, the prevailing type possesses certain defects not possessed by some of its sisters. These related strains, along with numerous "pure lines" out of Reward itself, are being investigated and studied very closely and we now have considerable reason to hope for something especially good from this material.

Reward, as it now exists, matures almost as early as Garnet (only three or four days later as a rule), produces an excellent quality of flour and a very fine appearing kernel. The straw is of medium length and of excellent strength. In comparative yielding tests conducted thus far, this variety has not made quite as good a showing as has Garnet in the majority of cases but these tests cannot be accepted as conclusive. Whether or not a "purified" Reward or one of its sisters may prove sufficiently superior in any particular region or regions to justify its introduction, remains for the future to decide.

THE PRODUCTION OF RUST RESISTANT WHEATS

Since the disease commonly known as *Wheat Stem Rust* has come to constitute a serious menace to the wheat crops of Manitoba and parts of Saskatchewan, special attention has been directed toward the development of varieties which might resist this scourge and still produce satisfactory yields of the desired quality. After the epidemic of 1916 which reduced the value of the western wheat crop by many millions of dollars, crosses were made between certain varieties which appeared to suffer little from the disease (but which were otherwise inferior) and such superior though relatively susceptible varieties as Marquis. The frequent recurrence of rust since the above date resulting in enormous losses, has stimulated further activity and has brought

* Newman and Whiteside "Garnet Wheat"—Bull. No. 83, 1927, Dominion Experimental Farms, Ottawa, Canada.

about the establishment (in 1924) of a special "Rust Research Laboratory" equipped to deal with the problem from all angles. This laboratory, while administered and operated jointly by officials of the Cereal Division and of the Botanical Division of the Federal Farm System, is located at the Agricultural College, Winnipeg, Man., in the heart of the "rust area". Here an excellent foundation has been laid and encouraging progress recorded by a very efficient and enthusiastic staff of scientifically trained workers. In this important undertaking the Committee of Scientific and Industrial Research of the Dominion is co-operating as are also the Agricultural Colleges of the three Prairie Provinces. Exceedingly valuable assistance and encouragement is also being received from certain United States institutions notably the University of Minnesota and the Agricultural College at Fargo, North Dakota.

The problem admittedly is complex and complicated and will require a considerable length of time before the final objective can possibly be reached. If this objective be attained, wheat growing over large areas will be restored to its former position of relative security and importance in so far at least as concerns wheat stem rust.

WORK BY PROVINCIAL INSTITUTIONS AND BY PRIVATE INDIVIDUALS

Since the creation and proper valuation of new varieties of wheat is a time-consuming undertaking, demanding many years of very careful work, and since the Dominion Experimental Farms System was the first Governmental body in Canada to undertake this work on a substantial scale it is not surprising that the leading varieties of spring wheat now grown in Canada emanated from this institution. Within comparatively recent years, however, the three Prairie Provinces particularly have been devoting much time and energy to the developing of superior new varieties or strains, some of which are likely to play an important part. Already some of these are quite promising but it is too soon to predict with any degree of assurance, just how valuable they may prove to be. Special mention, however, would appear to be due a variety known as Renfrew, recently introduced by the University of Alberta. This variety possesses good milling and baking qualities but is somewhat later than Marquis in maturing. In districts where early maturity is not particularly important, however, the former variety promises to become popular on account of its reputed superior yielding ability.

The history of Renfrew is not definitely known but this variety is believed to be a cross between Marquis and Red Fife.

Certain private individuals have also been doing excellent work in the selection and development of valuable "new forms" which nature herself has provided, presumably through "natural crossing," in most cases. Among these men special mention is due such well known seed growers as Seager Wheeler, of Rosethorn, Sask. This gentleman, operating as a member of the Canadian Seed Growers' Association, has introduced two varieties which have become fairly widely distributed, in certain sections of Saskatchewan and Alberta particularly, and which are of undoubted value when grown in localities to which they are adapted. We refer to the varieties known as Kitchener and Red Bobs. Both these varieties, unfortunately, are very susceptible to Wheat Stem Rust, but in certain districts outside the "rust areas" they have been proving quite useful. Red Bobs was rather mixed in type when first grown so lent itself readily to re-selection with the result that Mr. Wheeler has isolated two slightly different forms to which he has given the name Early Triumph and Supreme. These varieties appear to be gaining in popularity in certain districts and should be included in the list of those varieties which are contributing to the success of Canada as a wheat producer.

